



**Homeland Security
and Emergency Services**

New York State
Division of Homeland Security and Emergency Services
Hazard Mitigation Section
Archived Webinar Series

HazardMitigation@dhSES.ny.gov
www.dhSES.ny.gov/hazard-mitigation

Part 1: Benefit-Cost Analysis (BCA) Concepts



Benefit-Cost Analysis (BCA) | Concepts

To evaluate proposed hazard mitigation projects prior to funding, FEMA requires a Benefit-Cost Analysis (BCA) to validate cost-effectiveness.

The project's total net benefits divided by its total project cost is called Benefit-Cost Ratio (BCR). If the BCR is 1.0 or greater the project is considered cost-effective.

To ensure the project is cost-effective, applicant and sub-applicant must use FEMA-approved methodologies and the Supplemental Guidance for the BCA Toolkit V6.0.

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)

Email: bchelp@fema.dhs.gov



FEMA

Benefit-Cost Calculator v6.0.0

Welcome

Benefit-Cost Analysis (BCA) is the method by which the future benefits of a hazard mitigation project are determined and compared to its costs.

The end result is a Benefit-Cost Ratio (BCR), which is calculated by a project's total benefits divided by its total costs.

FEMA requires a BCA to validate cost effectiveness of proposed hazard mitigation projects prior to funding.

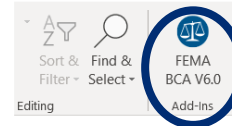
For a community and/or property, this tool will assist with:

- Estimating Annual Hazard Risks
- Evaluating Mitigation Cost Effectiveness
- Developing Aggregate Benefit-Cost Models

For more information, including methodologies of the calculation models used in this tool, visit [FEMA BCA Website](#).

Getting Started

Click on the "BCA Calculator" button on the ribbon bar.



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Part 2: Introduction to BCA Toolkit Version 6.0



Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

Benefit-Cost Analysis Toolkit

Download the official BCA Toolkit
V6.0 Excel template from:

<https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis>


Users will need Excel 2013 or later, or
may use Excel Online Option




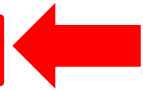
Due to Microsoft updates, users with older versions of Microsoft Windows and Excel (2013 and 2016) may experience functionality issues with the BCA Toolkit. If you are using an older version of Windows or Excel, FEMA recommends using the BCA Toolkit in [Excel Online](#).

To help complete an analysis within the required guidelines, you must use the BCA Toolkit, which is a calculator developed using FEMA-approved methodologies and tools to show the cost-effectiveness of your projects. Do your BCA early in the project development process to make sure you will meet the cost-effectiveness eligibility requirement.

BCA Toolkit Installation Instructions

Release Notes July 2020 

BCA Toolkit Version 6.0 



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Benefit-Cost Analysis (BCA) | Start

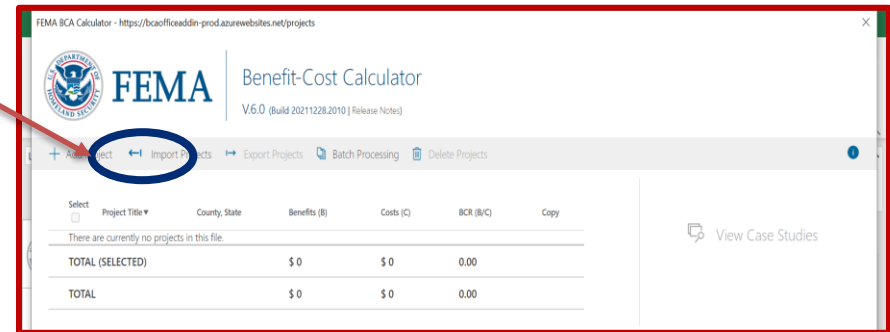
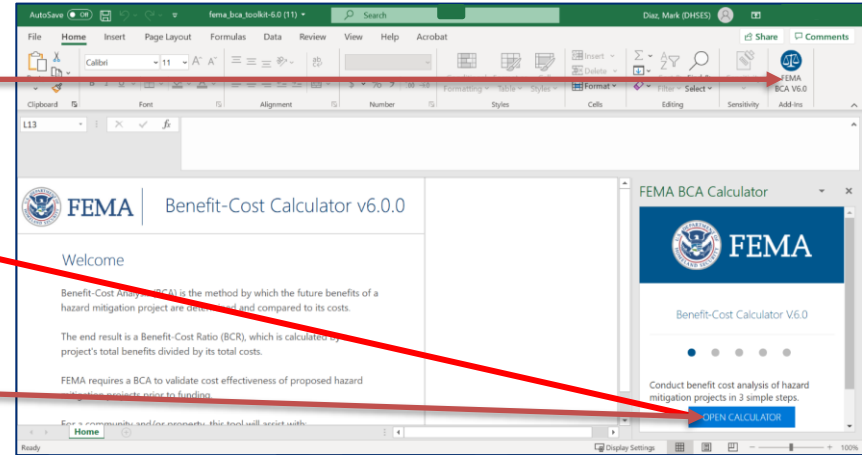
Initial Steps

Click FEMA BCA V6.0 Icon

FEMA BCA Calculator will appear on the righthand side of screen

Click “Open Calculator” to begin BCA in a new window

Click “Add Project” to begin



Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

When using the help button ⓘ.
Always use the inner “Close” button
after reviewing the content.

Where possible, default values have
been populated in the Toolkit.
Switch the toggle to “No” to
enter a custom value.

Make sure always provide comment
and documentation if you do not use
the default button.

New Mitigation Action

The screenshot shows the 'Project Configuration' form in the FEMA BCA Calculator. The form includes fields for 'Project Title' and 'Property Location', and toggle switches for 'Use Property Location?' and 'Use Decimal Degrees?'. A red box highlights the 'Close' button in the top right corner of the form. A red arrow points from the 'Close' button to the 'Use Property Location?' toggle switch, which is currently set to 'Yes'.



Benefit-Cost Analysis (BCA) | Project Configuration

Project Title – Input the same title as used in the sub-application for the project:

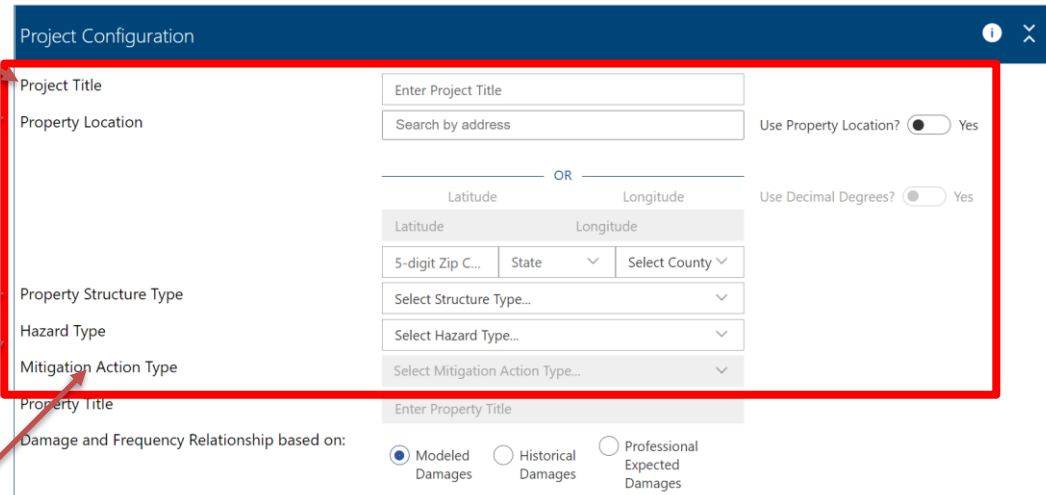
Town of Sample_Main Street Culvert Upgrade

Property Location- Important to use correct address and GPS coordinate (Lat/Long) of the project .

Property Structure Type – Drop down selection (buildings, utilities, roads & bridges, or other)

Hazard Type – Drop down selection for the primary hazard being mitigated

Mitigation Action Type – Drop down selection that best relates to the proposed scope.



The screenshot shows a 'Project Configuration' form. A red rectangular box highlights the main input fields. Red arrows point from the text descriptions on the left to specific fields in the form:

- An arrow points from 'Project Title' to the 'Enter Project Title' input field.
- An arrow points from 'Property Location' to the 'Search by address' input field.
- An arrow points from 'Property Structure Type' to the 'Select Structure Type...' dropdown menu.
- An arrow points from 'Hazard Type' to the 'Select Hazard Type...' dropdown menu.
- An arrow points from 'Mitigation Action Type' to the 'Select Mitigation Action Type...' dropdown menu.

The form includes the following fields and options:

- Project Title:** Enter Project Title
- Property Location:** Search by address
- Use Property Location?:** ☒ Yes
- OR**
- Latitude/Longitude:** Latitude, Longitude
- Use Decimal Degrees?:** ☐ Yes
- 5-digit Zip C...:** State (dropdown), Select County (dropdown)
- Property Structure Type:** Select Structure Type... (dropdown)
- Hazard Type:** Select Hazard Type... (dropdown)
- Mitigation Action Type:** Select Mitigation Action Type... (dropdown)
- Property Title:** Enter Property Title
- Damage and Frequency Relationship based on:** ☒ Modeled Damages, ☐ Historical Damages, ☐ Professional Expected Damages



Benefit-Cost Analysis (BCA) | Project Configuration

Damage and Frequency Relationship

Modeled Damages –

Select this option to perform the analysis on the property, regardless of past damage history. The BCA results for the selected hazard will be modeled based on the inputs provided. Mostly critical facilities and residential/nonresidential facilities have this option

Historical Damages –

Select this option if: Historic damages and losses, and the dates (years) are available.

- Sources of documents for Damages - Insurance claims, damage repair records, data from State/local agencies, newspaper citing, FEMA Project Worksheets (PW)

Professional Expected Damages –

Select this option if: the scientific data would show how much damage would result, If a given event were to occur.

- For example, a study for a drainage improvement shows the projected flood depths for a group of homes if the 100-year flood were to occur. Using the flood depths, calculate how much damage would occur.

Project Configuration

Project Title

Enter Project Title

Property Location

Search by address

Use Property Location? ☒ Yes

OR

Latitude

Longitude

Latitude

Longitude

Use Decimal Degrees? ☐ Yes

5-digit Zip C...

State

Select County

Property Structure Type

Select Structure Type...

Hazard Type

Select Hazard Type...

Mitigation Action Type

Select Mitigation Action Type...

Property Title

Enter Property Title

Damage and Frequency Relationship based on:

☒ Modeled Damages
 ☐ Historical Damages
 ☐ Professional Expected Damages



Benefit-Cost Analysis (BCA) | Generators

For Generators, the modeled damages module is not available.

In order to set up the BCA analysis for Generators, the Damage and Frequency Relationship needs to be Historical Damages or Professional Expected Damages.

For Hazard Type, infrastructure failure can be selected because the project will mitigate power loss or uncategorized can be selected when multiple hazards are impacting the critical facility.

Project Configuration

Project Title: Generators

Property Location: 1220 Washington Ave, Albany, New York, 12226

Use Property Location? ☐ Yes

OR

Latitude: 42.6634091 Longitude: -73.8105267

12226 New York Albany

Property Structure Type: Critical Facility Building

Hazard Type: Select Hazard Type...

Mitigation Action Type: Select Mitigation Action...

Please select a Mitigation Action Type.

Property Title: Enter Property Title

Damage and Frequency Relationship based on:

☐ Modeled Damages ☒ Historical Damages ☐ Professional Expected Damages

Cost Estimation

Enter the Project Loss of Life Search: 0

Enter the Initial Project Costs (\$): 0

Enter the Number of Maintenance Years: 0

Enter the Annual Maintenance Costs (\$): 0

Total Mitigation Project Cost (\$): 0

Select Hazard Type...

- Riverine Flood
- Coastal A Flood
- Coastal V Flood
- Coastal Unknown Flood
- Hurricane Wind
- Hurricane Safe Room
- Tornado Safe Room
- Wildfire
- Drought
- Landslide
- Seismic
- Dam/Levee Break
- Extreme Temperature
- Infrastructure Failure
- Severe Storm
- Tsunami
- Volcano
- Winter Storm
- Uncategorized

Benefit-Cost Analysis (BCA) | Cost Estimation

Project Useful Life (PUL) - Length of time that the mitigation project will provide protection. Help content has the FEMA standard values in PUL Summary Tables.

Initial Project Costs - Includes all costs required for completing the project, which is more than just construction, except the management fee of the project.

Number of Maintenance Years - The default is the same value as the Project Useful Life based on typical situations.

Annual Maintenance Costs - The annual cost which will be necessary for the upkeep of the components and the proposed mitigation project. Usually is less than what is the current upkeep.

Total Mitigation Project Cost - This field is auto-calculated from the above inputs.

Cost Estimation

Enter the Project Useful Life (years): 0

Enter the Initial Project Costs (\$): 0

Enter the Number of Maintenance Years: 0 Use Default? ☐ Yes

Enter the Annual Maintenance Costs (\$): 0

Total Mitigation Project Cost (\$) 0

Project Useful Life

The Project Useful Life Summary Tables below provide the Standard Values for hazard and project types. The tables also show the Acceptable Limits of the PUL value. If a value other than the Standard Value is used, documentation and justification are required. For example, a generator vendor could provide documentation to demonstrate that the PUL is longer than the standard value (19 years). Even with documentation, a PUL value cannot be higher than the highest Acceptable Limits value. The higher the PUL, the higher the BCR since project benefits will be considered farther into the future.

PUL Summary Tables

Flood

Project Type	Standard Value	Useful Life Acceptable Limits (documentation required)	Comment
Acquisition / Relocation			
Acquisition / Relocation	100	100	
Building Elevation			
Residential Building	30	30-50	
Non-Residential Building	25	25-50	
Public Building	50	50-100	
Historic Buildings	50	50-100	
Mitigation Reconstruction			
Mitigation Reconstruction	50	50	

Benefit-Cost Analysis (BCA) | Damage Frequency Assessment

Year of Analysis Conducted - Typically the current calendar year.

Year Property was Built - When the asset being mitigated was built.

– i.e., buildings, utilities, roadways and bridges, other assets.

Analysis Duration - Auto-calculated from the above inputs.

Professional Expected, Or Historical Damages before Mitigation.

(Add row) for each event.

Recurrence Interval - Frequency of event which caused the historic damage or the expected damages to happen.

If Historical damages chosen, use

<https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf>

Damage Analysis Parameters - Damage Frequency Assessment

Year of Analysis Conducted:

2021

Year Property was Built:

1950

Analysis Duration (years):

72

Use Default?

☒

Yes

Professional Expected Damages Before Mitigation

Damages Before Mitigation

Add Row

Delete Row(s)

		OTHER		OPTIONAL DAMAGES		VOLUNTEER COSTS		TOTAL
SELECT	RECURRENCE INTERVAL (YEARS)	DAMAGES (\$)	Detour (\$)	Category ...	Category ...	NUMBER OF VOLUNTEERS	NUMBER OF DAYS	DAMAGES (\$)
<input type="checkbox"/>	11	2,075,998.19	3,709,521	0	0	0	0	5,785,519
<input type="checkbox"/>	31	5,643,033.13	6,182,535	0	0	0	0	11,825,568
<input type="checkbox"/>	50	5,189,995.48	8,655,549	0	0	0	0	13,845,544
<input type="checkbox"/>	100	6,227,994.57	12,365,070	0	0	0	0	18,593,065

View Annualized Results



Benefit-Cost Analysis (BCA) | Recurrence Interval

Recurrence intervals and probabilities of occurrences

Recurrence interval, in years	Probability of occurrence in any given year	Percent chance of occurrence in any given year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

A recurrence interval (RI) is a frequency of an event which caused the historic damage.

The USGS clarifies that the RI is based on the probability that the given event will be equaled or exceeded in any given year.



Benefit-Cost Analysis (BCA) | Recurrence Interval

When working specifically within the Historical Damages approach, note a requirement for analysis:

- Minimum of one known-frequency event or a minimum of three unknown-frequency events.

If at least three unknown-frequency events are provided, there is a built-in Unknown Frequency Calculator feature that auto-calculates RI values.

- Typically assumes that events are occurring in different years.
- If more than one damaging event occurred in a single calendar year, the user should request guidance from the BCA Helpline.

Damage Analysis Parameters - Damage Frequency Assessment

Year of Analysis Conducted: 2022

Year Property was Built: 1990

Analysis Duration (years): 33

Use Default? ☐ Yes

Historical Damages Before Mitigation

Damages Before Mitigation

+ Add Row - Delete Row(s)

SELECT	DAMAGE YEAR	RECURRENCE INTERVAL (YEARS)	OTHER DAMAGES (\$)	Categ...	Categ...	Categ...	NUMBER OF VOLUNTEERS	NUMBER OF DAYS	DAMAGES (\$)	CURRENT DOLLARS?	INFLATED DAMAGES (\$)
<input type="checkbox"/>	1996	0.00	57,000...	0.00	0	0	0	0	57,000	<input checked="" type="checkbox"/> No	127,875
<input type="checkbox"/>	2011	0.00	118,00...	0.00	0	0	0	0	118,000	<input checked="" type="checkbox"/> No	161,526
<input type="checkbox"/>	2012	0.00	230,00...	0.00	0	0	0	0	230,000	<input checked="" type="checkbox"/> No	306,788
<input type="checkbox"/>	2017	0.00	125,00...	0.00	0	0	0	0	125,000	<input checked="" type="checkbox"/> No	144,542

View Annualized Results

FEMA BCA Calculator - <https://bcaofficeaddin-prod.azurewebsites.net/projects>

Annualized Results: Before Mitigation

Annualized Recurrence Interval (years)	Damages and Losses (\$)	Annualized Damages and Losses (\$)
8.5	127,875	3,963
11.3	144,542	4,534
17	161,526	9,897
69.61	306,788	4,407
Sum Damages and Losses (\$)		Sum Annualized Damages and Losses (\$)
740,731		22,801

Benefit-Cost Analysis (BCA) | Recurrence Interval Resources

Advanced Technology Council data for hurricane windspeed and seismic data by location:

<https://hazards.atcouncil.org/>

National Weather Service, Precipitation Frequency Data Server:

<http://hdsc.nws.noaa.gov/hdsc/pfds/>

NOAA National Centers for Environmental Information: Storm Events Database at

<https://www.ncdc.noaa.gov/stormevents>

U.S. Geological Survey stream gage data at <https://waterdata.usgs.gov/ny/nwis/sw> can be used to extrapolate frequency information for flood events.

- See section 2.1.2 from Supplement to the BCA Reference Guide (2011).

Read more on this topic from USGS at: <https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods>



Benefit-Cost Analysis (BCA)

Standard Benefit: Ecosystem

These benefits are great for Acquisition and any project that helps to create open space, Riparian, Wetland, Forests, Marine Estuary.

Social benefits:

When the project provides services for the community. How many residence does the project serve? How Many of those residences work?

Benefit Cost summary:

Auto Populates and results in Benefit Cost Ratio (BCR).

Standard Benefits - Ecosystem Services	
Total Project Area (acres or sq.ft):	0
Enter the percent land use of the project area below:	
Green Open Space (%)	0
Riparian (%)	0
Wetlands (%)	0
Forests (%)	0
Marine & Estuary (%)	0
Expected Annual Ecosystem Services Benefits (\$)	0

Additional Benefits - Social	
Note: Available only if Residential and Benefit Cost Ratio is greater than or equal to 0.75	
What is the Number of Residents?	0
How many of the 0 Resident(s) work?	0
Expected Annual Social Benefits (\$):	0

Benefit-Cost Summary	
Total Standard Mitigation Benefits (\$):	\$ 0
Total Social Benefits (\$):	\$ 0
Total Mitigation Project Benefits (\$):	\$ 0
Total Mitigation Project Cost (\$):	\$ 500,877
Benefit Cost Ratio - Standard:	0.00
Benefit Cost Ratio - Standard + Social:	0.00

FINISH



and Emergency Services

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

Roads and bridges or Projects effecting roads and bridges:

Estimated Number of One-Way Traffic Detour Trips per Day:

Additional Time per One-Way Detour Trip (minutes):

Number of Additional Miles:
Federal Rate (\$):

Economic Loss Per Day of Loss of Function (\$):
Use Default? yes

Or with documentation choose NO as default and provide the value.

Roads and Bridges Properties

Estimated Number of One-Way Traffic Detour Trips per Day:	<input type="text" value="0"/>	
Additional Time per One-Way Detour Trip (minutes):	<input type="text" value="0"/>	
Number of Additional Miles:	<input type="text" value="0"/>	
Federal Rate (\$):	<input type="text" value="0.56"/>	Use Default? <input checked="" type="radio"/> Yes
Economic Loss Per Day of Loss of Function (\$):	<input type="text" value="0"/>	



Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

- A BCA submission consists of a BCA file (Excel) and BCA report (PDF)
- After pressing the Finish button. You be able to view the report by clicking the view report
- Place the curser on top of the page and drag it down to view the excel file. Save the excel file for future use.
- Use the Print report to either print or save it as PDF.
- Allot a separate folder for the supporting documentation.
- Once the BCA submission is final, check all the comment boxes, check all the references to all documents.
- Place all files into a ZIP file.
- Use a consistent naming scheme throughout, which would aid the review process.

FEMA Benefit-Cost Calculator
V6.0 (Build 20211228.2010 | Release Notes)

Benefit-Cost Analysis
Project Name: BROOKHAVEN, TOWN OF

Home + Add Mitigation Action Delete Mitigation Action View Report

Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)	Copy
1	Acquisition @ 40.8773560; -72.8589390	House	DFA - Coastal A Flood	\$ 0	\$ 500,877	0.00	
TOTAL (SELECTED)				\$ 0	\$ 500,877	0.00	
TOTAL				\$ 0	\$ 500,877	0.00	

Close Report Print Report

Questions



Part 3: Pre-Calculated Benefits



Benefit-Cost Analysis (BCA) | Pre-Calculated Benefits

acquisition projects (buyout): if the cost of the project is under \$323,000 per structure and located in the SFHA then no BCA is required.

elevation projects: if the cost of the project is under \$205,000 per structure and located in the SFHA then no BCA is required.

buyout/elevation local multiplier: can be added to the threshold cost results in higher costs by geographic location

- https://www.constructionworkzone.com/estimating_tools/regional_cost_adjustments.

hospital generators: ≤ \$6.95 per hospital building gross square footage (BGSF) in urban areas and \$12.62 per hospital BGSF in rural areas.

- must have an emergency department
- stand-alone solution

precalculated benefits FEMA guidance:

- <https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis>

Pre-Calculated Benefits

To streamline the grant application process, FEMA has released pre-calculated analyses for several eligible projects.

- [Acquisitions and Elevations in the Special Flood Hazard Area \(SFHA\)](#)
- [Residential Hurricane Wind Retrofits](#)
- [Non-Residential Hurricane Wind Retrofits](#)
- [Individual Tornado Safe Rooms](#)
- [Hazard Mitigation Grant Program Post Wildfire](#)
- [Hospital Generators](#)
 - [Methodology Report](#)

The pre-calculated benefits and benchmark costs are not intended to drive actual project costs or to serve as detailed project cost estimates. Individual project cost estimates must be based on industry standards, vendor estimates or other acceptable sources. Projects must still meet all other grant requirements.

Example: Acquisition of three properties;

Structure 1	\$170,000	
Structure 2	\$380,000	
Structure 3	\$299,000	
Total	\$849,000	Average \$283,000 (less than \$323,000)

Example: Elevation of three structures;

Structure 1	\$195,000	
Structure 2	\$210,000	
Structure 3	\$175,000	
Total	\$580,000	Average \$193,333 (less than \$205,000)

To account for potential higher project cost based on geographic location, the pre-calculated benefit amounts listed above may be adjusted by using the most current locality multipliers. The multiplier should come from an industry accepted construction cost guide (i.e., RS Means) and a copy of the source document must be provided.

Example: Newburgh, NY – BNi Building News provides a regional multiplier for 19% above national average, therefore, \$323,000 + 19% = \$384,370 pre-calculated benefits for acquisition project.



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Benefit-Cost Analysis (BCA) | Additional Resources

FEMA's 2009 BCA Reference Guide**: https://www.fema.gov/sites/default/files/2020-04/fema_bca_reference-guide.pdf

FEMA's 2011 Supplement to the BCA Reference Guide**: https://www.fema.gov/sites/default/files/2020-08/fema_bca_guide-supplement.pdf

FEMA's July 2020 BCA Toolkit 6.0 Release Notes: https://www.fema.gov/sites/default/files/2020-08/fema_bca_toolkit_release-notes-july-2020.pdf

FEMA BCA Toolkit 6.0 Installation Instructions: <https://www.fema.gov/fact-sheet/fema-bca-toolkit-60-installation-instructions>

FEMA's 2019 Benefit-Cost Analysis Training Materials (E/L 0276 course): <https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis/training>

FEMA's BCA Landing Page, including a section on Pre-Calculated Benefit materials: <https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis>

FEMA Flood Map Service Center (MSC): <https://msc.fema.gov/portal/home>

** Though their content is based on use of BCA Toolkit version 5.3.0, especially the included screenshots, the general principles discussed still apply to date in BCA Toolkit version 6.0.



Homeland Security
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Questions



Part 4:
Additional Information
&
Q&A



DHSES Mitigation Technical Assistance Contact

DHSES has a team available and ready to provide

- Technical assistance with application development,
- Assistance with the Benefit-Cost Analysis (BCA)
- Assistance to applicants who are not familiar with the mitigation grant process.

Please reach out to the DHSES Mitigation Team for more information:

Call us at: hazradmitigation@DHSES.NY.GOV

<https://www.dhSES.ny.gov/hazard-mitigation>



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Questions

